

generally deeper than the interannular furrows and the only visible external metameric character; most somites 3-annulate. Clitellum ill-defined, somite X not modified, XI and XII somewhat narrower, about as wide as the first nuchal annulus, XII embraced at its caudal end by the anterior fold of the wider first abdominal annulus, into which it is slightly recessed; somites XI and XII triannulate dorsally, biannulate ventrally, the second annulus of XI enlarged in the medial ventral field to encroach upon the first annulus of XII, and bearing the ♂ gonopore; on venter all clitellar annuli longer than those of the preceding somites; gonopores (Fig. 2) separated by two annuli, the ♂ on the caudal margin of XI *a3*, the ♀ at XII *a2/a3*, both small and obscure, especially the female, which on the type is concealed beneath the edge of projecting rim of somite XIII but on the paratype is exposed. Abdomen much wider than neck throughout, outline elliptical, the greatest width near middle at somites XVIII-XX (relatively much wider in the type) moderately depressed; cephalic end truncate but not expanded shoulderlike, embracing the last clitellar annulus, but prepucal fold only slightly developed; caudal end tapered to the sucker, for which it forms a definite peduncle; no lateral pulsatile vesicles and no other external metameric structures (nephropores, sensillae) discernible, except that intersegmental furrows are usually deeper than the others. Abdominal somites typically 3(6)-annulate but some of them definitely 6-annulate with the primary triannulation obscure, furrows often irregular or incomplete. Anus a well marked pore on the caudal peduncle followed by two incomplete annuli. Caudal sucker about twice size of cephalic in all dimensions, deeply cupped, regular, directed caudad, with about 48 minute marginal crenulations; dorsal face areolated and divided by faint furrows into three or four obscure concentric rings, each of which bears a circle of very minute papillae which are most distinct on the smooth ventral face. No natural color remains, but the type is stained a uniform green, which may be due to preservation in a copper tank.

Annulation (Fig. 1).—Often irregular and in places, especially at clitellum and caudal end of abdomen, difficult to interpret. On most somites primary and secondary furrows are distinguishable by their relative depth but in places this distinction is lost. I-V, cephalic sucker (head), no annuli distinguishable except some faint traces of one or two at caudal end. VI 2-annulate, first annulus (*a1 a2*) larger and very distinct, separated from sucker by a deep nuchal furrow, the second (*a3*) very small and not separated ventrally. VII 2 or 3-annulate, *a1* separated as a very short annulus on paratype, not distinct on type; furrows irregular and incomplete on both. VIII 3-annulate, similarly irregular, with split and spiral primary annuli. IX and X 3-annulate both dorsally and ventrally, *a3* largest on X with a faint secondary furrow. Normally X is first clitellar, but on these specimens apparently not closely united with XI externally. XI 2- or 3-annulate, definitely clitellar, (*a1 a2*) > *a3* with a faint *a1/a2* furrow on the dorsum, which disappears on the venter where *a3* is enlarged medially and produced caudad into XII as a small lobe bearing the ♂ gonopore on its caudal margin. XII 2- or 3-annulate, 3rd clitellar, similar to XI but shorter, more crowded, and partly concealed by XIII, *a1* less developed than on XI and *a3* possibly slightly subdivided, ♀ gonopore very minute at *a2/a3*, beneath prepucal fold on type. XIII 3-annulate, sharply defined by deep furrows from both XII and XIV and abruptly larger than former, with a moderately developed prepucal fold, which partly encloses it. XIV and XV 3-annulate, with *b5* and *b6* indicated on both paratype and type by a slightly developed *b5/b6* furrow and *b1* and *b2* on the former; owing to contraction the annuli of both crowded together and piled

up, making the region very opaque. XVI-XXII normally 3(6)-annulate. The normal condition is that the three primary annuli are approximately equal and each divided by shallower furrows into two secondary annuli, but because of different degrees of contraction of the two specimens and of greater or less engorgement of different gastric caeca of the same specimen there is much irregularity. On the type specimen the triannulate condition dominates but the shallower secondary furrows are usually present, especially on the more contracted side, where annuli stand out more prominently, but *a3* is rarely and *a2* more frequently undivided. On the paratype XVI to XIX are much distended by the large blood-filled caeca, which stretch the integument so that it is thin and transparent and the distinction between primary and secondary furrows is nearly lost (Fig. 1). This shows best on XVI and XVII. XVIII-XXII more typical, all annuli may be equal or *a2* smaller and *a3* larger. XXIII-XXV 3-annulate, but progressively reduced in size and the annulation very irregular, especially on the type. XXVI and XXVII 2-annulate, but irregular, the latter much smaller and bearing the anus on the anterior margin of the first annulus.



Fig. 4.—*Austrobdella anoculata*: Dorsal and ventral photographic views of type. $\times 3\frac{1}{2}$.

Anatomy (Fig. 3).—Some of the internal organs can be seen through the integuments sufficiently to determine their position and roughly their form, but the details were worked out from sections of the paratype in which some of the structures were obscured by the engorged gastric caeca. Anatomy closely patterned after that of the genotype, *A. translucens*. Ventral nerve ganglia of complete somites in annuli *a2*, chiefly in *b4*. Pharynx with medial ventral and paired dorsolateral muscular ridges; salivary glands diffuse, of very large single cells in somites VII-X. Gastric caeca seven pairs in XIII to XIX, the first six reaching nearly to the lateral body walls and lobed at the ends, the last pair coalesced completely except at the caudal end, where the two caeca remain distinct for a longer distance than in *A. translucens*; intestine with two or three pairs of small simple caeca at the anterior end, following which it expands into a wide, simple sac reaching nearly to the end of the united gastric caeca and giving rise from its dorsal face a short distance anterior to its caudal end to a narrow, tubular rectum which ends at the anus. Reproductive organs similar to those of *A. translucens* except that the median chamber of the atrium is relatively smaller and the duct shorter; cornu large and sperm ducts with several loose coils at the atrial end; testes five pairs at XIV/XV to XVIII/XIX, alternating with gastric caeca. Vagina a simple vertical duct with only a slight enlargement and not expanded into a sac or bulb but encased in a mass of glands; it divides beneath the nerve cord into the paired ovarian sacs lacking the narrow duct and anterior lobe shown by Badham, both ovisacs very short, the one reaching to XIII only, the other to the middle of XIV, both containing developing ova in early stages.

Material examined.—Two specimens, one of which, the holotype, U.S.N.M. no. 20573, was obtained in 25 to 40 fathoms between Capes Alexander and Chalon, northwest Greenland, by Capt. Robert A. Bartlett, August 2, 1937 (station 27, seine haul). The other specimen, the paratype, comes from northeast Greenland, where it was collected by Captain Bartlett in 1930 (No. 14).

Remarks.—Owing to the limited material and its indifferent preservation, it has not been possible to arrive at such unequivocal conclusions and to prepare as satisfactory a description as could be wished. Many nominal species of fish leeches have been described from Arctic and sub-Arctic waters. Some of the early descriptions are so brief and ambiguous that the species to which they refer have never been certainly determined. Synonymies are still confused. It is possible that the species here described may belong to one of these, but none were found to agree. Concerning the generic reference there is little doubt. On a preliminary study it was thought that these leeches might belong to *Abranchus* or *Ottonia*, but externally the form and annulation differ from those genera and internally the coalescence of the last pair of gastric caeca is sharply differential.

On the other hand, the resemblance to *Austrobdella*, both externally and internally is very close. So far as it could be worked out, the annulation agrees closely with that of *A. translucens* Badham. The external form and proportions of parts are very similar. Neither of the two specimens is so strongly shouldered at the junction of the neck and abdomen as in Badham's most mature individuals. The anatomy of the alimentary canal and reproductive organs, so far as worked out, is very close in the two species, the principal differences being that in the type species the last pair of gastric caeca are more completely united at the caudal end than in *A. anoculata*, and that the ovisacs of the latter are not prolonged caudally and have the vaginal duct short and simple. These ovarian differences may be due to immaturity. Owing to the state of the material, a study of the distribution of the sinuses was not attempted.

ICHTHYOLOGY.—*Hadropterus palmaris*, a new darter from the Alabama River System.¹ REEVE M. BAILEY. (Communicated by LEONARD P. SCHULTZ.)

In a collection of fishes from the Etowah River in northern Georgia, six specimens of a hitherto undescribed species of *Hadropterus* were taken. Twenty-seven additional specimens from two localities in Alabama have been placed at my disposal through the generosity of Dr. Carl L. Hubbs.² This handsomely colored species is herein described under the name *Hadropterus palmaris*.³

¹ Received August 24, 1940. Journal Paper no. J791 of the Iowa Agricultural Experiment Station, Ames, Iowa. Project no. 651.

² I am indebted to Dr. Hubbs for helpful suggestions in preparing this paper.

³ *Palmaris* = a prize.

***Hadropterus palmaris*, new species**

Fig. 1

BRONZE DARTER

Holotype.—An adult male (Univ. Michigan Mus. Zool. no. 126179), 65.5 mm in standard length, collected in the Etowah River, known locally as the High Tower River (tributary to the Coosa River, tributary to the Alabama River), just above the bridge at U. S. Highway 19, 4 miles southwest of Dahlonega, Lumpkin County, Ga., on August 25, 1939, by Reeve M. and Marian K. Bailey (field no. B39:59).

Paratypes.—Five specimens were taken with the holotype: U.M.M.Z. no. 126180 (2), U. S. National Museum no. 117881 (2), Iowa State College no. 1 (1). U.M.M.Z. nos. 111232 and 111133 (23) collected in Saugahatchee Creek (tributary to the Tallapoosa River), Ala., October 24, 1930, by F. E. Guyton. U.M.M.Z. no. 111234 (4) collected 3 miles east of Tuskegee, Macon County, Ala., June 3, 1931, by F. E. Guyton.

Diagnosis.—A highly colored species of *Hadropterus* with moderate sized scales, 59 to 73 (usually 69 or fewer) along lateral line; nape and cheeks fully scaled; opercles imperfectly scaled (especially in adults); and midventral scales greatly enlarged in males. Dorsal XI to XIV-10 to 13, the soft portion high; anal II, 7 to 10; and pectorals 13 to 15. Preopercle entire. Gill membranes separated; the distance from their union to insertion of pelvic fins 0.75 to 0.95 in distance from tip of mandible to union of gill membranes. Snout short, 3.6 to 4.4 in head length. No subocular dark bar; dorsolateral surface punctated with dark; 2 large light spots at base of caudal.

Description.—The various body proportions (Table 1), fin-ray and scale-row counts (Table 2), and the photograph (Fig. 1) indicate clearly many of the characteristics of the species. The juveniles are seen to differ from the adults in their larger eyes, shorter snouts, and the somewhat greater distance between the union of the gill membranes and the tip of the mandible, but variations in body proportions within the species appear to be slight. The apparently broader interorbital width in the Alabama specimens seems to be due to preservation. In most of the fin-ray and scale-row counts (Table 2) the Alabama and Georgia specimens agree rather closely; but in lateral-line scale count the range of variation in the Alabama specimens is greater (59 to 73) than in those from Georgia (59 to 63). The increased number of pectoral rays in the Georgia specimens (average 14.8) as contrasted with those from Alabama (average 13.7) is notable.

The preopercle is entire, the horizontal arm scarcely longer than the vertical arm. The premaxillary frenum is slightly narrower than the thick, terminal, upper lip, and about two-thirds the diameter of the pupil. The moderately heavy mandibles are well separated, diverging but little for about three-fourths of their length from the symphysis, behind which they flare outward more sharply. The mandibular frenum is somewhat wider than the premaxillary frenum. The snout is bluntly deurved; the upper edge of the upper lips is on the level of the bottom of the eye, and the lower jaw is slightly included. In I.S.C. 1 the gill-rakers number 3+11, of which 1 above the angle and 4 below are very short. The longest gill-raker when depressed scarcely extends to the base of the second raker below. In the same specimen the vertebral count is 18+23=41 (hypural included); in the first caudal vertebra no haemal spine is developed but the haemal processes are united. The vomer bears a strong cluster of teeth, and the palatines are strongly toothed along their length. In *H. nigrofasciatus* the palatine teeth are few and restricted to the anterior portion of the bones.

TABLE 1.—MEASUREMENTS (TAKEN WITH DIVIDERS) OF 10 SPECIMENS OF *HADROPTERUS PALMARIS*¹

Measurement	1	2	3	4	5	6	7	8	9	10
	Etowah River, Lumpkin County, Ga.		Sauga-hatchee Creek, Ala.		Etowah River, Lumpkin County, Ga.		Sauga-hatchee Creek, Ala.		Etowah River, Ga.	
	U.M.M.Z.	U.S.N.M.	Holotype U.M.M.Z.	U.M.M.Z.	I.S.C.	U.S.N.M.	U.M.M.Z.	U.M.M.Z.	U.M.M.Z.	U.M.M.Z.
	126180	117881	126179	111233	1	117881	111233	126180	U.M.M.Z.	111233
Sex.....	♂	♂	♂	♀	♂	♂	♀	♀	♀	♀
Standard length in mm.....	68.5	67.5	65.5	63.5	63.0	61.5	61.0	46.5	38.0	36.0
In standard length:										
Depth of body.....	5.15	5.1	5.35	5.2	5.2	5.6	5.4	6.0	5.3	5.8
Length of head, including opercular membrane.....	3.7	3.8	3.75	3.95	3.9	3.8	3.8	3.8	3.05	3.7
In length of head:										
Width of body.....	2.1	2.05	2.0	1.7	1.95	2.05	1.75	2.1	1.85	1.95
Depth of caudal peduncle.....	2.7	2.6	2.55	2.55	2.6	2.55	2.7	2.65	2.9	2.8
Highest dorsal spine.....	2.8	2.7	2.5	2.8	2.5	2.85	2.9	3.1	2.6	2.6
Highest dorsal soft ray.....	1.8	1.7	1.65	1.75	1.8	—	1.75	2.1	1.9	1.85
Highest anal ray.....	1.85	1.6	1.6	1.55	1.7	1.65	1.55	1.65	1.85	1.8
Longest caudal ray.....	1.6	1.45	1.4	1.5	1.55	1.35	1.35	1.35	1.35	1.35
Longest pectoral ray.....	1.05	.95	.95	1.0	.95	1.0	1.05	1.0	1.1	1.0
Length of pelvic fin.....	1.1	1.05	1.05	1.15	1.1	1.1	1.2	1.1	1.2	1.2
Depth of head.....	1.6	1.6	1.65	1.65	1.6	1.7	—	1.8	1.8	1.7
Width of head.....	1.6	1.45	1.7	1.75	1.7	1.75	1.7	1.8	1.85	1.8
Length of eye.....	4.9	4.7	4.5	4.5	4.4	4.5	4.6	4.1	3.85	3.9
Length of snout.....	3.6	3.95	4.0	4.0	3.95	4.1	3.8	4.1	4.4	4.4
Length of upper jaw.....	3.4	3.6	3.7	3.4	3.65	3.7	3.4	3.7	3.85	3.75
In length of snout:										
Length of eye.....	1.4	1.2	1.15	1.1	1.15	1.1	1.3	1.0	0.95	0.95
In length of eye:										
Least fleshy interorbital width.....	1.5	1.5	1.6	1.25	1.7	1.5	1.35	1.6	1.5	1.45
In distance from tip of mandible to union of gill membranes:										
Distance from insertion of pelvic fin to union of membranes.....	0.85	0.75	0.8	0.8	0.8	0.85	0.85	0.95	0.95	0.9
Length of eye.....	2.4	2.3	2.2	2.2	2.15	2.35	—	2.2	1.85	1.95

¹ Largely following the format employed by Hubbs and Raney (1939, pp. 5-6) in their description of *H. ozyrhychnus* (Occ. Pap. Mus. Zool. Univ. Mich. no. 396, pp. 1-9, pl. 1).

TABLE 2.—FREQUENCY DISTRIBUTIONS OF FIN-RAY AND SCALE COUNTS¹ ON *HADROPTERUS PALMARIS* (the counts of the holotype are indicated by asterisks).

Locality	Dorsal spines				Dorsal soft rays ²				Anal soft rays ²				Caudal branched rays ³		
	11	12	13	14	10	11	12	13	7	8	9	10	13	14	15
Georgia.....	—	1	5*	—	—	2	4*	—	—	1	5*	—	—	2	4*
Alabama.....	1	10	15	1	1	18	6	2	2	12	10	3	1	19	7
Total.....	1	11	20	1	1	20	10	2	2	13	15	3	1	21	11

Locality	Pectoral rays (both sides)			Scale rows										
				Above lateral line			Below lateral line							
	13	14	15	7	8	9	10	11	12	13	14			
Georgia.....	—	3*	9*	1	5*	—	3	2*	—	1	—			
Alabama.....	16	36	2	1	20	6	3	2	8	12	2			
Total.....	16	39	11	2	25	6	6	4	8	13	2			

Locality	Scale rows																								
	Along lateral line														Around caudal peduncle										
	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	20	21	22	23	24	25				
Georgia.....	2*	—	1	—	3	—	—	—	—	—	—	—	—	—	—	—	2	1	2*	1	—				
Alabama.....	1	5	2	2	1	5	2	3	1	1	2	1	—	—	1	1	6	4	13	2	1				
Total.....	3	5	3	2	4	5	2	3	1	1	2	1	—	—	1	1	8	5	15	3	1				

¹ The scales above the lateral line were counted downward and backward from the origin of the second dorsal fin; those below the lateral line were counted upward and forward from the origin of the anal fin; those along the lateral line were counted to the base of the caudal rays; those around the caudal peduncle represent a minimum enumeration.

² The last ray of the soft dorsal and anal fins was counted as double at the base.

³ Seventeen principal caudal rays were counted in all specimens.

Five pores are given off by the lateral canal of the head, the anterior from a short downward projecting tube and the next three at the tips of long slender tubes, which project downward and backward. The supratemporal canal is complete, giving off a median pore from a short backward projecting tube, and one lateral pore on each side from longer and slenderer tubes that project backward and slightly downward. A single postorbital pore opens from a short backward projecting tube from the supraorbital canal on each side, and the interorbital pore of each side opens from a short tube that projects outward or outward and backward. The posterior nasal pore opens from a short tube just above the anterior end of the slitlike, posterior nostril. The anterior nasal pore lies anterodorsal to the tubular, anterior nostril. The coronal pore opens at the end of a long tube which may be curved slightly to the left or right. The infraorbital canal is complete with 8 pores; of which the anteriormost lies below and behind the anterior nostril, the second and third open from slender tubes near the edge of the maxillary groove, the

fourth emerges from a short upward projecting tube, and the posterior four open from long slender tubes that project downward and backward. Of the ten operculomandibular pores the six on the preopercle open from short, side tubes. The complete lateral line is very slightly arched anteriorly. (Nomenclature of canals and pores from Hubbs and Cannon, p. 10, pl. 2.⁴)

The genital papilla of the adult male is a depressed and rounded, conical projection, which is smooth except for a short, longitudinal groove near its tip; that of the female is broadly semicircular, with several deep grooves radiating forward and outward from the orifice.

The pelvic fins are separated by a space equal to about four-fifths of the pelvic base. Between the pelvics there are two or three enlarged median scales, which may or may not be followed posteriorly by a naked strip for two-fifths of the length of the pelvic fins. In males the remainder of the midline of the belly is provided with a series of greatly enlarged scales with long and very strong ctenii; in females these scales are scarcely or not at all enlarged and the ctenii are little developed. There are one or two slightly to moderately enlarged scales at the union of the pelvic bones near the middle

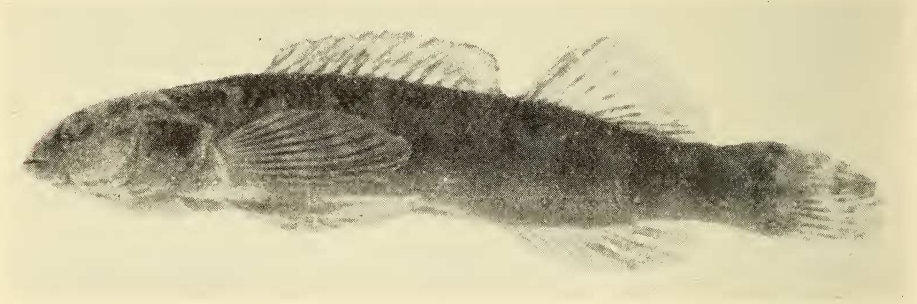


Fig. 1.—Paratype of *Hadropterus palmaris*, U.S.N.M. 117881, an adult male 67.5 mm in standard length, from the Etowah River, Ga. The photograph, of the right side of the fish but reversed in printing, was taken by Max E. Davis.

of the breast, and the subtriangular area between the pelvic bones is provided with small imbedded scales; otherwise the breast is entirely naked. The nape and cheeks are covered with well-developed imbricating scales; those of the cheek are in seven or eight rows as counted from the eye to the posteroventral angle of the preopercle. The opercles are provided with deciduous scales, varying from a complete absence of scales in some of the larger adults to an almost complete covering in juveniles. The holotype has five small, nonimbricate, imbedded scales on the left opercle and nine on the right.

The spinous dorsal is long and rather low and is narrowly separated from the soft dorsal. The soft dorsal and anal are large. The first of the two anal spines is much stronger but slightly shorter than the second. The margin of the caudal is slightly concave. The pectorals are broadest near their middle and extend as far back as the pelvics.

Coloration.—With the exception of *evides*, *palmaris* is the most colorful and handsome species of *Hadropterus* thus far described. In life the bodies of adult males were deep yellowish brown above, shading to dull olivaceous on the breast. On each side were eight to ten dark greenish-black vertical bars

⁴ *The darters of the genera Hololepis and Villora.* Misc. Publ. Mus. Zool. Univ. Michigan, 30: 1-93, pls. 1-3. 1935.